

REMARKS

Claims 1-20 were pending under this Office Action. Each of claims 1-20 was rejected. Claim 12 is now cancelled and claims 1, 6, 8, 14 and 18 hereby amended.

Favorable reconsideration of this application is respectfully requested in view of the amendments and following remarks. Each of pending Claims 1-11 and 13-20 is believed to be in condition for allowance.

I. Claim Rejections Under 35 U.S.C. § 102

In the Office Action, specifically in paragraph 2, Claims 1-5 were rejected under 35 U.S.C. § 102(e) as being anticipated by Noguchi, US Patent Publication No. 2003/0114000. Applicants respectfully submit that these claim rejections are obviated for reasons set forth below.

Independent Claim 1 has been amended to recite the feature of "forming a buffer zone on a surface of said copper layer by exposing said copper layer to an NF₃ plasma". As conceded by the Examiner in the claim rejections under Section 103 (see below) Noguchi fails to teach the use of F ions, much less a gas containing F ions, much less still an NF₃ plasma. Amended Claim 1 therefore includes features not disclosed by Noguchi and therefore the rejection of Claim 1 under 35 U.S.C. § 102(e) as being anticipated by Noguchi, should be withdrawn. Claims 2-5 depend, directly or indirectly, from amended independent Claim 1 and therefore also incorporate the distinguishing feature stated above. As such, Claims 2-5 are also distinguished from Noguchi and the rejection of Claims 2-5 under 35 U.S.C. § 102(e) as being anticipated by Noguchi, should similarly be withdrawn.

II. Claim Rejections Under 35 U.S.C. § 103(a)

In the Office Action, particularly in paragraph 6, Claims 6-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Noguchi, as above, in view of

Schonauer, US Patent No. 6,162,727. Applicants respectfully submit that these Claim rejections are overcome for reasons set forth below.

Claim 6 recites the features of:

"step of forming a buffer zone comprises applying controlled corrosion gas to said copper surface".

Furthermore, Claim 6 depends from Claim 1 which, as amended, recites the following feature of the "forming" as referenced by the above recitation and thereby incorporated into claim 6:

"forming a buffer zone on a surface of said copper layer by exposing said copper layer to an NF₃ plasma".

Independent Claim 8 has been amended and independent Claim 8 recites the feature of:

treating said copper layer with NF₃ plasma to form a buffer zone on a surface of said copper layer and in-situ depositing a capping layer over said copper layer.

Independent Claim 14 recites the feature of:

applying a gas containing F ions to said copper layer wherein said F ions remove said copper oxide and form a buffer zone on a surface on said copper layer and in-situ depositing a capping layer overlying said copper layer".

Neither Noguchi nor Schonauer teach or suggest a controlled corrosion gas and neither Noguchi nor Schonauer teach or suggest an NF₃ plasma. In fact, neither Noguchi nor Schonauer teach a F ion-containing gas or plasma. Noguchi is limited to treating the copper surface with hydrogen and does not disclose or suggest treating the copper surface with any other species. Schonauer, on the other hand, teaches dipping a copper surface in a wet solution containing 90% acetic acid and 10% ammonium fluoride and scrubbing with a double sided brush to remove contaminants from the copper surface. Schonauer does not even particularly discuss the reaction that occurs

to removed contaminants, much less discuss the role of fluorine (F) ions in such reaction.

Applicants respectfully submit that one of ordinary skill in the art and in possession of the Noguchi reference - *limited to hydrogen plasmas*; and the Schonauer reference - *limited to a wet solution of 90% acetic acid and 10% ammonium fluoride and used in conjunction with a scrubbing technique to clean copper*, would not see fit to combine the references to derive a process for treating a copper surface with an NF₃ plasma to form a buffer layer on the copper layer as recited in independent Claims 1 and 8. Applicants further submit that it would not be obvious to combine the two references to apply any other gas containing F ions to the copper layer or doing so in-situ with a subsequent process used to form a capping layer over the copper layer. It is well known in the art that the capping layer is formed using various plasma deposition processes and that forming the capping layer in-situ with the copper treatment, requires the copper treatment to be carried out in a gaseous environment. The Schonauer copper treatment therefore cannot be carried out in-situ with the formation of the capping layer.

Therefore, it is respectfully submitted that Claims 1, 8 and 14 are patentable because there is no apparent suggestion or motivation to combine the Noguchi and Schonauer references. In particular, Applicants submit that, one in possession of the Noguchi application and advised of Noguchi's copper treatment process that uses hydrogen to purportedly perform a superior copper surface cleaning process, would certainly not be motivated to look for any other method to clean the copper surface. As such, one would not be motivated to combine the Noguchi reference with the Schonauer reference. Moreover, the claimed invention including NF₃ plasma or a gas containing F ions is patenably distinct from the cited references - individually or as combined, because, even if combined, neither of the references discloses or suggests either of NF₃ or a gas containing F ions. Applicants therefore believe that the applied references have been improperly combined using hindsight reconstruction without

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evidence to support the combination, and even as combined, the references do not disclose the feature of a gas containing F ions in general, or an NF₃ plasma in particular.

Therefore, independent Claims 1, 8 and 14 are distinguished from the references of Noguchi and Schonauer, taken alone or in combination, and the rejections of Claims 6 (which depends from Claim 1), 8 and 14 under 35 U.S.C. § 103(a), should therefore be withdrawn. Claim 7 depends from Claim 1 and is similarly distinguished. Claims 9-11 and 13 depend from independent Claim 8 whereas Claims 15-20 depend from Claim 14. Since each of these Claims incorporate the distinguishing features of their base Claims, it is respectfully submitted that the rejection of each of Claims 6-11 and 13-20 under 35 U.S.C. § 103(a) should be withdrawn.

CONCLUSION

Based on the foregoing, each of Claims 1-11 and 13-20 are in allowable form and the application is in condition for allowance, which action is respectfully and expeditiously requested.

Respectfully submitted,

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Mark J. Marcelli, Reg. No. 36,593
Attorneys for Applicants

DUANE MORRIS LLP
101 West Broadway, Suite 900
San Diego, CA 92101
Telephone: (619) 744-2200
Facsimile: (619) 744-2201